Effective Implementation of Work-Hour Limits and Systemic Improvements

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An emerging body of research has demonstrated the risks to patients and providers alike of nurses' and resident-physicians' extended work hours, as discussed in the companion article by Lockley et al.[1] Concerns about the effects of long work hours on safety have prompted initial efforts to reduce providers' work hours in the United States, but to date, these efforts fall far short of what the evidence demonstrates to be optimal.

In this article, we outline current nationwide policies and initiatives in place in the United States and compare these initiatives to those in other countries. We then briefly describe two hospital-level initiatives that have been attempted to substantially redesign provider work schedules in a manner commensurate with the evidence on sleep and safety. Finally, we suggest a series of changes needed to bridge the gulf between current, tradition-based hospital scheduling practices in the United States, with their well-documented hazards, and emerging evidence-based scheduling practices that incorporate principles of sleep and circadian medicine, safe handoffs, and improved teamwork to provide safer care. To make this transition, several elements will be needed:

- Development and effective enforcement of evidence-based work-hour limits for physicians and nurses
- Dissemination of best practices in safe scheduling that adhere with these limits and incorporate principles of sleep and circadian medicine
- Development of infrastructural changes that support the implementation of shorter work hours, including

Article-at-a-Glance

Background: Sleep deprivation, ubiquitous among nurses and physicians, recently has been shown to greatly increase rates of serious medical errors and occupational injuries among health care workers in the United States.

Current Initiatives and Policies: The Accreditation Council for Graduate Medical Education's current work-hour limits for physicians-in-training allow work hours well in excess of those proven safe. No regulations limit the work hours of other groups of health care providers in the United States. Consequently, nursing work shifts exceeding 12 hours remain common. Physician-in-training shifts of 30 consecutive hours continue to be endorsed officially, and data demonstrate that even the 30-hour limit is exceeded routinely. By contrast, European health care workers are limited by law to 13 consecutive hours of work and to 48–56 hours of work per week. Except for a few institutions that have eliminated 24-hour shifts, as a whole, the United States lags far behind other industrialized nations in ensuring safe work hours.

Conclusions: Preventing health care provider sleep deprivation could be an extremely powerful means of addressing the epidemic of medical errors in the United States. Implementation of evidence-based work-hour limits, scientifically designed work schedules, and infrastructural changes, such as the development of standardized handoff systems, are urgently needed.

altered medical rounding structures and educational curricula, improved sign-out systems, and incorporation of technological tools that aid in patient care transitions

- Promotion of a team culture that emphasizes fully shared responsibility for patients

Adoption of work-hours reform has been hampered by concerns about the effects of reducing work hours on continuity of patient care, professionalism, and graduate medical education, as well as workforce and cost concerns. Although numerous opinions and nonvalidated surveys have been published on the effects of work-hour reduction on these outcomes, very few objective studies have been conducted. By contrast, a wealth of data demonstrates the hazards of long work hours. Effective implementation of safe work schedules will require a systemic approach that addresses the potential hazards of disrupted continuity and medical education, while ensuring provider alertness and safety. Objective, high-quality data will be needed to assess the relative merits of diverse solutions as they are implemented and to establish and widely disseminate best practices.

Survey of Current National Initiatives and Programs

Nurses, United States

In view of the mounting evidence on the relationships between nursing work hours, working conditions, and patient safety, in 2004 the Institute of Medicine (IOM) published a formal analysis of nurses' working environments. Given the strength of the evidence documenting the hazards of nursing shifts that exceed 12 hours, the IOM has recommended that *all nursing shifts of greater than 12 hours be eliminated.*[2]

To date, however, few hospitals have implemented this recommendation. In a study of American Nurses Association nurses, Rogers et al. found that 39% of all nursing shifts were 12.5 hours in duration or more, 14% of nurses studied reported having worked shifts of 16 hours or longer in the previous four weeks, 81% of shifts ran over their scheduled time limit, and mandatory overtime continued to be used in many hospitals.[3] A more recent study of critical care nurses largely substantiated these findings, demonstrating that most shifts worked by critical care nurses exceed 12 hours.[4] Neither a professional regulatory agency nor any state or federal government has regulated nursing work hours in private hospitals, despite the IOM report. However, the Veterans Health Affairs appropriations bill now requires that VA [Department of Veterans Affairs] facilities have policies to prevent nurses in direct patient care from working longer than 12 consecutive hours or more than 60 hours in a week.[5]

Physicians-in-Training, United States

Concerns about fatigue-related errors[6] have led to internal professional regulation of physician-in-training work hours, but the regulations enacted have been extremely limited both in scope and effectiveness. The Accreditation Council for Graduate Medical Education (ACGME) implemented work-hour limits for all physicians-in-training for the first time in July 2003. Under these rules, physicians-in-training must:

1. Work no more than 80 hours per week, averaged over a 4-week period
2. Have at least 1 day off in 7, averaged over a 4-week period
3. Work no more than 30 hours in a row, including time for patient care transitions, didactic learning, and continuing care for existing patients; no new patients may be admitted after 24 hours of continuous duty
4. Work extended overnight shifts (24+ hours) no more often than 1 night in 3, averaged over 4 weeks;
5. Have a 10-hour period free of work between all daily duty periods and after an extended shift[7]

Although the ACGME standards represent a first effort to address the long work hours of physicians-in-training in the United States, a major concern is that they continue to allow work durations well beyond those proven to be safe. Moreover, even these permissive limits are routinely exceeded. For example, in a nationwide study, we found that 84% of interns reported hours that violated the ACGME limits during at least one month; altogether, 62% of in-hospital months were in violation.[8]

In contrast to the 30 hours of continuous duty that the ACGME deems safe and acceptable for physicians and surgeons, workers in other safety-sensitive industries (for example, pilots, nuclear-power plant operators, truck and bus drivers, police) are limited to 12–16 hours of consecutive work. These limitations are based on current physiologic data demonstrating the adverse impact of long duty hours on workplace performance, health, and safety.

Practicing Physicians and Other Health Care Workers, United States

No limits exist in the United States for practicing physicians or other health care workers. Studying the prevalence and effects of sleep deprivation in these groups should be an important research priority.

Physicians, Nurses, and Other Health Care Workers, Europe

In sharp contrast to the experience in the United States, data on the effects of sleep deprivation on performance prompted the European Union in 1993 to develop the European Working Time Directive (EWTD), which was implemented by law in the United Kingdom in 1998. The EWTD restricts all workers in Europe—including nurses, physicians-in-training, and senior physicians—to a maximum of *13 consecutive hours of work and 48–56 hours of work per week*.[9] The U.K. weekly work limits have fallen from a previous limit of 72 hours per week (the "New Deal") to the current 56-hour limit; a limit of 48 weekly work hours will be enforced beginning in 2009.[9] All time spent in the hospital, whether asleep or awake, has been ruled by the European courts to count as work time.[10] A variety of schedules have been proposed to meet these requirements, which are only now beginning to be studied rigorously.[11]

Physicians-in-Training, New Zealand

Physicians-in-training in New Zealand have had work-hour limits in place for more than 20 years through a collective agreement between the resident union and the government's District Health Boards. Physicians-in-training are limited to a maximum of 72 hours per week and 16 hours of consecutive work.[12] Further, there is a contractual agreement to work toward a limit of 60 hours per week. As in Europe, numerous scheduling arrangements exist to meet these requirements in different hospitals and specialties, but little work has been conducted specifically evaluating the safety of the various extant methods of meeting work-hour limits.

Survey of Current Hospital Initiatives and Programs in the United States

Although progress in the United States to adopt evidence-based work-hour reforms has lagged behind that in other industrialized nations, a few initiatives have been implemented and tested in individual hospitals and hospital units. Two case studies from intensive care units, which typically have both some of the longest work hours and highest rates of medical errors,[13–15] are presented.

Example 1. Intern Sleep and Patient Safety Study[16,17]

Brigham and Women's Hospital (Boston) received support from the Agency for Healthcare Research and Quality (AHRQ) and the National Institute of Occupational Safety and Health (NIOSH) to conduct a reduced-work-hours demonstration project for interns rotating through the medical intensive care unit (MICU) and cardiac care unit (CCU). Interns who consented to participate were randomized to work a traditional "q3" schedule with recurrent, traditional 24-hour shifts in either the MICU or CCU and an intervention schedule in the other unit.

Methods. The intervention (1) restricted interns' scheduled work to ≤ 16 consecutive hours and (2) reduced weekly work hours by dividing each traditional 30-hour extended duty in half between two interns (See Figure 1 [page 23] and Figure 2 [page 24] for overall schema and for an example of one intern's work and sleep schedule). Rotations were distributed throughout the year to minimize seasonal and learning effects.

Interns' sleep durations, work hours, and medical error rates were systematically measured and compared on the two rotation schedules. Participants documented their sleep and work hours using daily logs, which were validated in turn by electroencephalography (EEG) and third-party documentation of work hours collected by research assistants. Errors were detected using a comprehensive active-surveillance methodology that included use of trained physician observers who monitored the performance of study interns 24 hours per day, seven days per week (while the study interns were working), as well as daily medical record review and solicitation of reports of all suspected errors from clinical staff. Detailed information was collected on all suspected errors detected by any method, and the errors were subsequently rated by two independent reviewers blinded as to study condition.

Results. On the traditional schedule, interns worked 19.5 hours more per week (84.9 versus 65.4 hours, $p <$

.001), slept 5.8 hours less per night ($p < .001$), and experienced more than twice as many objectively documented intrusive attentional failures during night work hours ($p = .02$). Furthermore, interns made 35.9% more serious medical errors (136.0 versus 100.1 per 1,000 patient-days, $p < .001$) and 5.6 times as many serious diagnostic errors (18.6 versus 3.3 per 1,000 patient days, $p < .001$) on the traditional schedule as compared with the intervention schedule.

In evaluating the safety of the system as a whole (e.g., errors due to interns and all other providers), the same general pattern held: There were 22% more serious medical errors and 96.4% more serious diagnostic errors on the traditional schedule. Rates of medical errors by senior residents, attending physicians, nurses, and other providers (none of whose schedules were affected by the intervention) did not change significantly.

Implications. This study demonstrated that elimination of interns' traditional 24–30 hour shifts led to significantly safer care, despite the presence of many avoidable miscommunications on the intervention schedule. During the study, sign-outs between interns on the intervention schedule were not supervised and were often suboptimal, and concerns arose that interns on the intervention schedule were not always as prepared on teaching rounds as those on the traditional schedule, especially during presentation of patients during morning rounds. Despite this, however, care was far safer on a schedule that reduced interns' sleep deprivation.

In addition to demonstrating overall safety gains on a schedule that eliminated 24-hour shifts, this experience taught important lessons about care continuity. First, in an intervention that reduces work hours, ensuring continuity of care is a high priority both for patient safety and for acceptance of the intervention by staff. Second, however, a system that decreased care continuity but simultaneously reduced sleep deprivation was far safer than a traditional schedule that sought to ensure care continuity by requiring the presence of physicians-in-training for 24–30 hour shifts; the effects of sleep deprivation outweighed the effects of discontinuities. Regardless, though, an important lesson has been to develop infrastructural supports that optimize continuity, teamwork, and medical education while seeking to reduce trainees' hours. Doing so may lead to even greater safety gains than those observed in the Intern Sleep and Patient Safety Study and may also help facilitate acceptance and perpetuation of these schedules.

Example 2: Mayo 14-Hour Work Shift Pilot[18]

Mayo Clinic (Rochester, Minnesota) studied the effects of implementing a 14-hour work-shift model in a medical intensive care unit.

Methods. In this pilot intervention, physicians-in-training moved from a system where they had been working traditional 24–30 hour shifts every four nights (a "q4" schedule) to a system where their scheduled work was limited to 14 consecutive hours. Severity-adjusted patient outcomes, trainees' performance on end-of-rotation exams, and scheduled hours were compared during the pre- and postintervention periods.

Results. Resident-physicians' scheduled weekly work hours decreased from 73.3 to 61.3 hours following implementation of the intervention. Fellows' (advanced trainees') work hours also decreased from 73.3 to 65.3 hours. No statistically significant differences were detected in mortality, hospital length of stay, or trainees' scores on end-of-rotation knowledge exams between the pre- and postintervention periods.

Implications. Although the power to detect statistically significant differences in mortality and other important outcomes was limited in this study, the authors concluded that implementing a 14-hour shift system is a feasible option for housestaff rotation in the medical intensive care unit. They found no evidence of compromised patient care or medical education.

This study, along with the experiences in Europe and New Zealand, demonstrates the pragmatic feasibility of implementing shorter work shifts. Although further work is needed to compare means of reducing hours and patient safety in alternative hours-reducing initiatives, such interventions are possible to initiate both in the United States and abroad.

A handful of residency programs in New York, Ohio, Massachusetts, and elsewhere in the United States have begun to act on these and related studies and to eliminate 24-hour shifts. Data on the experiences of some of these programs are likely to be forthcoming and will help to further guide future implementation efforts. Data from hospitals implementing work-hour limits for nurses and other providers are also needed.

Pattern of Three Interns on the Traditional Schedule and Four Interns on the Intervention Schedule, Covering Intensive Care Unit Patient Care During the Course of One Week

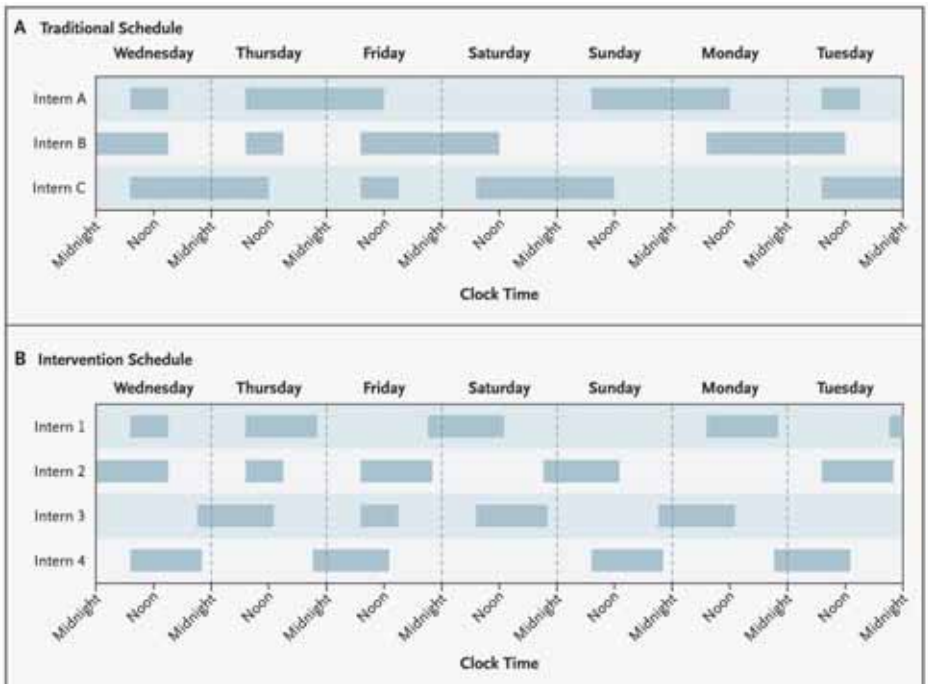

Figure 1. *In this figure, dark bars represent scheduled work. Vertical dashed lines represent midnight of each day over the course of the week. In the traditional schedule, shifts of 30 consecutive hours occur regularly. In the intervention schedule, the maximum scheduled shift length is 16 hours; a handoff occurs between the "day-call" and "night-call" intern between 9:00 P.M. and 10:00 P.M. (for example, Interns 4 and 3, respectively, on Wednesday). Reproduced with permission from Landrigan C.P., et al.: Effect of reducing interns' work hours on serious medical errors in intensive care units.* N Engl J Med *351:1838–1848, Oct. 28, 2004. Copyright © 2004 Massachusetts Medical Society. All rights reserved.*

Implications for Practice and Policy: Evidence-Based Work-Hour Limits

The profound increases in serious medical errors, diagnostic errors, motor vehicle crashes, occupational injuries, and reported patient injuries and deaths attributable to providers' long work hours are alarming and call the safety of current scheduling systems very much into question. In Europe and New Zealand, as described, such concerns have led to the implementation of work-hour limits enforced by law or by contractual agreement between providers and hospitals. In the United States, ACGME has implemented very limited regulations, but the evidence would suggest that more stringent restrictions will be needed to significantly reduce the risk of serious medical errors and injuries due to excessive work hours.

Professional and accreditation bodies in American health care have begun to address this issue. For example, The Joint Commission considered including "prevent[ing] patient harm associated with health care worker fatigue" as a National Patient Safety Goal for 2006, 2007, and 2008."[19]

Resident-Physician Work-Hour Limits

In 2004 the Sleep Research Society convened a

Pattern of Reported Work Hours and Sleep in a Single Representative Intern Working in an Intensive Care Unit (ICU)

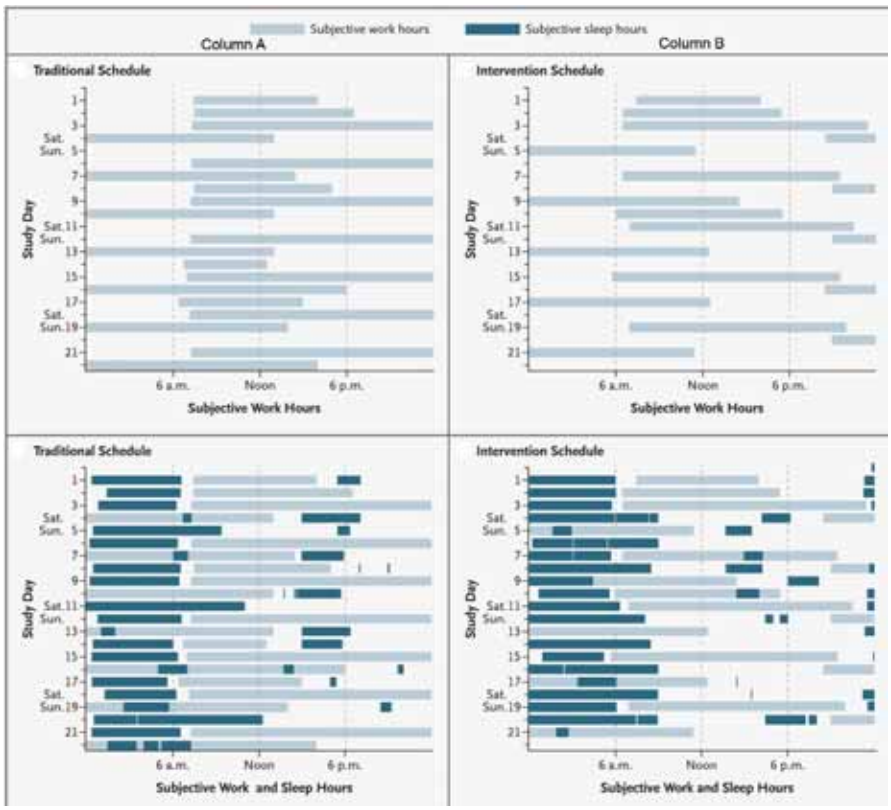

Figure 2. *The figure shows the pattern of reported work hours and sleep in a single representative intern when working in an ICU during (A) a traditional on-call schedule including extended-duration work shifts (24–30 hours) every other shift and during (B) an intervention rotation when scheduled work hours were limited to 16 hours continuous duty. Sequential study days are shown on the ordinate of each panel, with weekend days included for reference, and clock time is shown on the abscissa. Both work rotations started on a Wednesday (day 1) and ended on a Tuesday (day 21) unless the last work shift was scheduled to be overnight (e.g., days 21 through 22 in Panel A). Work hours are shown by the pale bars with sleep times, including sleep at work, superimposed in the dark bars. During the traditional on-call schedule, a team of three residents rotated sequentially through a three-day work pattern consisting of a "swing" shift from 7:00 A.M.–3.00 P.M. on the first day of each sequence (for example, Day 2, Thursday, Panel A) followed by an extended-duration work shift from 7:00 A.M. on the second day to the afternoon (~1:00 P.M.) of the third day (e.g., Days 3–4, Friday to Saturday, Panel A). During the intervention schedule, four residents completed a four-day rotating coverage schedule consisting of an identical swing day (e.g., Day 2, Thursday, Panel B), followed by a day-call shift (7:00 A.M–10:00 P.M., Day 3, Friday, Panel B), before returning the next day for the night-call (9:00 P.M.–1:00 P.M Days 4–5, Saturday night through to Sunday afternoon, Panel B). A one-hour handoff was scheduled between the day- and night-call (9:00P.M.–10:00 P.M.).*

The intern shown above worked an average of 83.4 hours per week during the traditional schedule, as compared with 62.6 hours per week during the intervention schedule. The group work-hour averages (± standard deviation) on each schedule were 84.9 (± 4.7) and 65.4 (± 5.4) hours/week, respectively (n = 20). This subject slept 41.8 hours per week during the traditional schedule and 47.8 hours per week during the intervention schedule, compared to group averages of 45.9 (± 5.9) and 51.7 (± 6.0) hours/week, respectively (n = 20). Reproduced with permission from Lockley S.W.: Effect of reducing interns' weekly work hours on sleep and attentional failures.
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Presidential Task Force on Sleep and Public Policy, charged to review the literature on sleep deprivation and safety and to develop model regulations that could be applied in health care, particularly for physicians-in-training. The key provisions of the Task Force's recommendations are as follows[20]:

1. Weekly work hours of physicians-in-training should be limited to an optimal maximum of 60 hours of work per week, and a fixed maximum limit of 80 hours of work in any week.

2. Consecutive work should be limited to an optimal limit of 12 hours of consecutive work, with a maximum limit of 18 consecutive hours of work in any setting, including time for the transition of patient care information.

3. Physicians-in-training should have 16 hours free of all duties following a shift of > 18 consecutive hours, and at least 10 hours free of all duties after work shifts of shorter than 18 consecutive hours.

4. Physicians-in-training should have at least 36 consecutive hours free of work including two consecutive nocturnal periods once every seven days, and a 60-hour consecutive period free of work once every four weeks.

5. Physicians-in-training who are assigned to patient care responsibilities in an emergency department or other high-intensity setting where the probability and/or potential consequence of a medical error is high should work no more than 12 continuous hours in that setting.

6. Physicians-in-training should not be scheduled to work an 18-hour shift more often than every third night.

These model guidelines have been endorsed by the National Sleep Foundation as well as the Sleep Research Society.

In view of the public health and safety implications of providers' long work hours, state governments or the federal government may choose to regulate them as well. In the United States, hours of service of truckers, pilots, and workers in other high-risk industries have been regulated for many years. Bills to limit physician-in-training work hours have been filed in the U.S. House and Senate for each of the past several years,[21,22] but have stalled in committee. A petition to OSHA to limit trainees' work hours was filed several years ago[23] but was turned down when ACGME announced it would implement its Duty Hour Standards in 2003. Given the poor compliance with these standards and recent evidence that the limits themselves are inadequate to prevent fatigue-related harm, however, further action by governmental agencies could potentially occur.

The Sleep Research Society Presidential Task Force recommendations are evidence-based and much more in line with regulations in other safety-sensitive industries in the United States and with regulations for physicians-in-training in Europe and New Zealand than are the current ACGME standards. The applicability of such regulations to practicing physicians should also be considered, although data evaluating sleep deprivation in senior physicians is quite limited to date. Concerns with implementing such regulations would certainly include potential disruptions in continuity of care, but such disruptions could be addressed through means other than requiring an individual to stay in the hospital continuously for a protracted period of time. Another concern may be the cost of such an intervention, yet up-front costs are likely to be mitigated by savings due to decreased medical errors and injuries; formal cost-effectiveness analyses of the Sleep Research Society–recommended work limits are needed.

Nurse Work-Hour Limits

The IOM's recommendation that nurses' shifts be limited to a maximum of 12 consecutive hours[2] are consistent with the work-hour limits in most other safety-sensitive industries. As is the case with physicians, however, effective regulation does not currently exist. Implementation and enforcement of safe work-hour limits for nurses will be an essential starting point to eliminating fatigue-related errors and injuries in hospitals in the United States.

Implications for Practice and Policy: Developing Best Practices in Safe Scheduling

Beyond the implementation of work-hour limits, dissemination and testing of physiologically based scheduling solutions in diverse health care settings is also needed. Not all schedules that reduce work hours will lead to improvements in sleep and alertness; careful consideration of circadian factors, the biologic sleep homeostat, chronic sleep deprivation, and sleep inertia are needed in the design of new schedules.[1] Even within evidence-based total work limits, schedules may not optimally promote sleep or

reduce fatigue. For example, the European Working Time Directive currently requires physicians and nurses in Europe to work a maximum of 56 hours per week. On paper, a series of seven consecutive 8-hour night shifts would fulfill the administrative requirements but is highly unlikely to be the safest way to implement a 56-hour limit.[24,25] Testing of diverse physiologically based approaches to schedule reduction and work-limit compliance is needed to determine which schedule-reduction strategies lead to the highest level of alertness and patient safety.

Schedule Design

Although schedules should be individualized to local requirements, important considerations when designing new schedules are as follows[26]:

1. Avoid consecutive nights on duty because sleep between night shifts is liable to be poor, causing a buildup of chronic sleep deprivation over multiple nights.

2. Allow at least one day off after a night on duty to enable sufficient sleep to recover from acute sleep deprivation.

3. Minimize the duration of continuous duty at night to avoid the need to sleep on-shift and thereby reduce the risk of sleep inertia.

4. If day shifts are extended as a result of minimizing night-shift duration, allow time for a long recovery sleep after the extended day shift.

5. Introduce a sleep health education program for health care professionals to emphasize the major role of their behavior for ensuring that they are maximally rested prior to coming on duty.

Key to these behavioral interventions is enabling and encouraging providers to take a nap before coming onto night shift, thereby interrupting the buildup of sleep pressure through the day. This is vitally important on the first night shift of any sequence because the health care workers are likely to wake at a normal time (e.g., 8:00 A.M.) and may remain awake all day before starting their night shift, causing severe fatigue overnight as a result of the interaction between the acute sleep deprivation and the circadian rhythm in sleepiness.

Other considerations for health care providers and schedule planners are as follows:

1. Plan adequate recovery sleep following a long day shift or night shift.

2. Prioritize sleep routinely, even when working normal day shifts, to prevent chronic sleep deprivation.

3. Rotate shifts if necessary in a delay direction (for example, day to evening to night).[27,28]

Although naps can be beneficial,[29,30] they are not an adequate substitute for sufficient sleep episodes and should be managed such that there is adequate time to overcome sleep inertia before doing critical tasks. Work hours should not be scheduled to their maximum legal limits. Providers will often work several hours longer than scheduled to care for their patients[17,31] and should not be discouraged from doing so. In the Intern Sleep and Patient Safety Study, residents worked longer than 16 hours (16–20 hours) on ~40% of occasions.[16] A work-hours "buffer" therefore needs to be included within the regulations to allow for regular spontaneous shift extensions.

Sleep Hygiene

Basic measures to ensure good-quality sleep, such as sleeping in a cool, dark, comfortable room with the use of eye masks and ear plugs if necessary, and turning off mobile phones, pagers, radio, and the television when sleeping to avoid interruptions, should be used. Although unnecessary when obtaining sufficient sleep, caffeine is widely used as a stimulant, and therefore caffeine use reeducation may form part of a comprehensive fatigue management program. Given its long half-life, caffeine can significantly affect subsequent sleep,[32] and, at higher doses, can induce negative neurobehavioral effects. When using caffeine, as when sleep deprived, individuals are also less able to gauge their own sleepiness,[33] further emphasizing the difficulty in relying on self-evaluation for assessing sleepiness. If residents choose to, using caffeine in low doses and relatively often (for example, one cup of normal coffee or caffeinated soda every two hours, with avoidance of espresso or "energy" drinks) and stopping any caffeine intake at least five to six hours before planning to sleep, will optimize its alerting effects while minimizing the negative impact on sleep. Use of other stimulants in residents should also be carefully assessed, given the potential to adversely affect subsequent sleep.[34]

Comprehensive Fatigue Management Programs

Work-hour limits, schedule reforms, education on sleep

hygiene, and education on countermeasures are the basic elements of a comprehensive fatigue management program. An ideal program would seek evidence-based approaches to schedule redesign and work-hour reduction and would provide educational programs to train staff about optimal sleep hygiene and optimal use of countermeasures to fatigue such as naps and caffeine. It should also provide screening for sleep disorders, which may contribute additional risks of fatigue-related errors and injuries on the job.

Implications for Practice and Policy: Developing Improved Communications

To reduce providers' work hours without increasing errors in care due to the introduction of excessive discontinuity (that is, poor handoffs between providers), a systemic redesign will be needed, with development of appropriate infrastructural supports for a system based on shorter work shifts. Handoffs of care are particularly important and have been a source of ongoing concern as initial efforts have been made to reduce residents' work hours. Although addressing these concerns is essential, however, such concerns should not preclude reducing work hours. Rather, systems of communication and reduced work hours should be developed in parallel, so that each improves in concert.

In the Intern Sleep and Patient Safety Study, even with a greater number of handoffs and a reduction in time on duty of 20 hours/week, residents made many fewer errors and performed a significantly greater number of procedures.[17,18] However, as concerns with communication remain important, development and testing of systems to improve transfer of patient information remains an area of major potential benefit as such transfers have to occur regardless of the resident scheduling—only the frequency, not the presence, of handoffs change with introduction of work-hour regulations. Each handoff of patient care should be concise but complete and standardized in a manner that minimizes miscommunications. The use of optimized rounding structures and technological tools to facilitate accurate handoff is an ongoing area of research. Similarly, the use of standardized communication strategies (for example, Situation-Background-Assessment-Recommendation[35]) to improve the consistency of verbal handoffs has also been strongly recommended by AHRQ and the Department of Defense to reduce communication errors. Such efforts are part of a larger need to improve the functioning of diverse professionals within hospitals as cohesive teams.

Implications for Practice and Policy: Leadership and a Culture of Teamwork

Development of teamwork, critical redesign of schedules, and the larger need to think continuously about safety improvement in hospitals are ultimately cultural issues. Hospital leaders play an essential role in facilitating the adoption of new systems of care in hospitals and in helping to shift medical culture to accept needed reorganizations. Strong leadership can create an environment where critical self-analysis and improvement are practiced in earnest. The reorganization of health care workers' schedules to improve the safety of care is complex and challenging but is feasible in a committed organization.

Conclusions

Reduction of provider sleep deprivation represents a major opportunity to improve both patient and provider safety in the United States. Studies have repeatedly demonstrated that a substantial portion of serious medical errors and provider occupational injuries are attributable to providers' long work hours. Effective amelioration of these errors and injuries, however, will require fundamental reforms in current hospital scheduling practices. It will also require deep changes in cultural attitudes surrounding work hours, safety, professionalism, and teamwork. As efforts are made to safely reduce work hours, consideration of continuity of care, handoffs, and trainee education will be essential. However, none of these concerns pose insurmountable barriers to prompt action to reduce unsafe provider work hours. With careful planning, the investment of hospital leadership and staff, and the development of robust cultures and systems of teamwork, continuity of care can be preserved as work hours are made safe. Accomplishing this task should be a major objective of the American health care system, if we wish to translate the findings of patient safety research into measurable gains for our patients. J

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